

## Vernacular Computing and the iSchools

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First of all, I want to thank you for inviting me to talk to you this evening. It's an honor to be here, and to deliver the Lazerow lecture, sponsored by Thomson Scientific, at the newly renamed College of Information, here at the University of North Texas. I also bring greetings from the iSchools consortium, a group of 25 schools dedicated to teaching and research at the intersection of people, information, and technology—a group which your College of Information has just recently joined.

The remarks I have for you tonight are about the intersection of people, information, and technology, and about the work that is being done at that intersection in the iSchools, but it is more importantly about a world outside of the the university, in which all of us spend more and more of our everyday lives, namely the world of vernacular computing on the public networks.

About my use of the term “vernacular” here: This adjective usually refers to something that uses “the native or indigenous language of a country or district.” And you do sometimes see the term, used this way and paired with computing, but I'm interested, actually, in a different sense of “vernacular,” closer to its use in the phrase “vernacular architecture,” which refers to “architecture concerned with ordinary domestic and functional buildings rather than the essentially monumental” (OED). My topic, then, is “ordinary domestic and functional” computing, rather than computing as a specialized activity involving monumental resources.

There is, of course, a potential overlap between the two senses of “vernacular computing,” since locally situated computing in everyday life may often involve computing in the indigenous language. But my main interest today is not in the language issues as such, but in the impact of a relatively new kind of “everyday computing” on the future of higher education, and in the special role that I think colleges of information, such as this one, have to play in that future.

I recognize that there are significant differences across different communities in terms of penetration of the internet/web into daily life. There are also important differences across (and within) institutions of higher education. We know that social, economic, and local cultural factors can have profound influence on the adoption, diffusion, and use of new technologies: but it is also possible to discern trends over time, and even to generalize a bit about where those trends are taking us. My information about trends is drawn from The Pew Internet & American Life Project, which is

“one of seven projects that make up the Pew Research Center, a nonpartisan, nonprofit 'fact tank' that provides information on the issues, attitudes and trends shaping America and the world. The Project produces reports exploring the impact of the internet on families, communities, work and home, daily life, education, health care, and civic and political life.”

The first part of the talk draws heavily on the Pew Project's reports, because those reports show us a great deal, I think, about who we are and who we are becoming. I first studied the reports of this project in 2004, but I have returned to it periodically since then, as it is updated and expanded, and it continues to reward attention; I hope the same can be said of what follows.

In a 2003 lecture called “Why Technology Matters: the Humanities in the 21<sup>st</sup> Century,” Stan Katz (past president of the American Council of Learned Societies) “reviewed some [1999] library scholarship on use of computing and the Internet” and reported that “several knowledgeable American librarians, surveying usage by their university faculty and graduate student patrons, find that academic humanists are not much interested in the broader digital humanities or even in the use of routine online scholarly resources.” My own background is in the humanities, and much of my work has been about bringing information technology to bear on humanities research; I can report that much has changed, even in the humanities, in the ten years since 1999, and the pace of change seems to me to have accelerated since 2003, but it is probably still fair to say that the humanities are the part of the university least changed by information technology; all the same, I'm not sure that those academic disciplines where computing has become more naturalized are, in fact, much more changed by, or more aware of, what I'm calling vernacular computing.

Looking back on the 1999 research from 2003, Stan found it hard to imagine that there were very many academics who still resisted the use of online resources like Google. By 2009 that battle is long over, though the outcome is owing mostly to convenience rather than conviction. Still, it's a little bit sad to be claiming this as a victory, if you consider the fact that the internet and the World-Wide Web are the *inventions* of universities and scientific research centers, and they have been with us for nearly 40 years (in the case of the internet) and the web itself has now been around for almost 20. The Web, in particular, has led to an extremely rapid and unforeseen uptake of internet-based communication by the general public, so much so that the force of innovation now seems to be coming from outside, rather than inside, the university.

Some of that innovation is technical in nature, some involves standards, but much of it has to do with new forms of communication, new genres, new uses of the technology. These are areas in which the iSchools, in particular, should have a great deal to contribute, not only in terms of critical or historical perspective, but in the direct engagement with new technologies of communication and the exploration of new landscapes of information.

In the last quarter of the 20<sup>th</sup> century, experimental networks emerged from the university and were, at first gingerly, picked up by the general public. The most interesting applications for these networks came out of the university world, at this stage: the Ethernet protocol was developed in Bob Metcalfe's (initially unsuccessful) Harvard dissertation (1973); the first MUD (multi-user dungeon) was developed at the University of Essex (1979); DNS—name-server technology—was developed at the University of Wisconsin (1983); Archie (anyone remember Archie? An early system for listing software available on file-servers) was developed at McGill University (1990); Gopher came out of the University of Minnesota in 1991—the same year in which the World-Wide Web made its first appearance, with a text-only browser; Veronica (a search tool for gopherspace, romantically linked to Archie) came out of the University of Nevada (1992); Mosaic, the first graphical web browser and the mother of Netscape, IE, and all other browsers that we use today, was released on April 22<sup>nd</sup>, 1993 from NCSA, at the University of Illinois, Urbana-Champaign. In the year following the release of Mosaic, Web traffic grew at an annual rate of 341,634% (all facts c.f. Hobbes' Internet Timeline v8.0). Apparently, a picture is worth much more than a thousand words.

Fast-forward to 2004, just about a decade after Mosaic: The networks are thoroughly public in nature, and they are now thoroughly naturalized by the public. According to Pew, at

this point more than 60% of Americans are online:

On a typical day at the end of 2004, some 70 million American adults logged onto the internet to use email, get news, access government information, check out health and medical information, participate in auctions, book travel reservations, research their genealogy, gamble, seek out romantic partners and engage in countless other activities. That represents a 37% increase from the 52 million adults who were online on an average day in 2000 when the Pew Internet & American Life Project began its study of online life. . . . The Web has become the “new normal” in the American way of life; those who don’t go online constitute an ever-shrinking minority.

A year later, in 2005, the Pew Survey reported that the 60% of Americans online increased—in one year—to 73% of American adults; since then, interestingly, the percentage has remained in the low seventies.

Over the years, the Pew reports note a diminishing but still a significant digital divide—along lines of age, income, primary language, and location. According to the 2004 report, younger Americans are much more likely to be online than senior citizens . . . richer and better educated Americans are more likely to use the internet than those with less income and education. . . only 38% of those with disabilities use the internet. . . rural Americans are less likely to be online than suburban and urban Americans. . . [and] blacks are less likely to use the internet than whites.

Most of those “more likely” or “less likely” comparisons are still true, but the gaps have closed somewhat. In December 2008, Pew found that 75% of adult women in America use the internet, vs. 73% of men. 87% of those 18-29 are online, but 41% of those over 65 are also now online

(up from 25% from 2004). 77% of whites, 64% of blacks, 58% of hispanics are online. 71% of urban dwellers, but now also 63% of rural dwellers. Also online: 94% of those making over \$75,000 a year, and 57% of those making less than \$30,000; 95% of those with college degrees; 35% of those with less than high school education.

Broadband is the leading edge of internet adoption in everyday life—and a priority for the Obama administration. It's also a transformative, according to the 2004 Pew report—once people experience it, they require it:

[m]ore than half of Americans who go online now have access to always-on connections at home or work, and they are different kinds of users than those with dial-up connections. They spend more time online. They do more online activities, especially those that exploit bigger information “pipelines,” such as accessing streaming video. They are much more likely to create content and share it with the rest of the online population. And they report greater levels of satisfaction with the role of the internet in their lives.

According to Pew, the national average for broadband at home was 13% in 2002, but it nearly doubled to 25% in 2004, and nearly doubled again to 42% in 2006. The rate of adoption slowed in 2007, rising to 47% in 2007, and then accelerated a bit again, rising to 55% in April 2008. At this point, fewer than 10% of Americans use dial-up at home. Broadband adoption among African Americans increased at a rapid rate between 2005 and 2006, but since 2007 it has slowed, and it remains in the low 40% range---43% in 2008. In the 2005 to 2006 timeframe, home broadband was used by 8% of seniors; in 2008, it's now 29% of those 65 and older, making this one of the fastest growing demographics in home broadband.

In general, I think what you find when you look at these numbers carefully, whether for internet

use in general, or for broadband adoption, is that rates of adoption are highest where the overall percentage is low, and (not surprisingly) as these numbers pass 50% the rate of increase slows. With broadband, there's some overall slowing in the rate of adoption that is apparently due partly to price and partly to (lack of) access. To the extent that the issue is price or access, Obama's next-generation broadband initiative should make a difference. However, perhaps the most interesting leading indicator, for the purposes of this talk, is the note in "Home Broadband Adoption 2008" that a third of the Americans who are online have connected to the internet using Wifi at a place other than home or work. More about that in a bit.

The trends in what people do online are also interesting, for our purposes. In 2004, the Pew survey said:

[E]mail is still the killer app. It is the No. 1 activity and time consumer for the vast majority of internet users. Next comes information searching, then entertainment, then e-commerce.

Email and information retrieval are still the top two, in 2008, but below that level, the list has diversified quite a bit, partly because more specific questions are being asked, but that's probably a result of more activities being available. In 2008, Americans use the internet daily as a source of news, entertainment, work-related research, social networking, watching video, interacting with the government and with the health care system, finding directions, playing games, downloading music, paying bills, shopping, filesharing, listening to the radio, making phone calls, participating in auctions, taking a class, finding a date, and many other things.

One of the most interesting findings of that 2004 Pew study, for me, has to do with the effect of being online, as reported by the individuals surveyed:

People use email to deepen their connection to the people they like and love and increase

the volume of communication they have with them. Email users, especially women, feel they are working on relationships and tending to their social networks as they exchange email. . . . 84% of internet users, or close to 100 million people, belong to groups that have an online presence. More than half have joined those groups since getting internet access; those who were group members before getting access say their use of the internet has bound them closer to the group. Members of online groups also say the internet increases the chances that they will interact with people outside their social class, racial group or generational cohort. ([http://www.pewinternet.org/PPF/r/148/report\\_display.asp](http://www.pewinternet.org/PPF/r/148/report_display.asp))

The social networking application of the moment is Twitter: in the most recent Pew poll, 11% of online Americans used it for one-to-many slightly asynchronous communication:

Twitter users are overwhelmingly young. However, unlike the majority of other applications with a similarly large percentage of youth, Twitter use is not dominated by the youngest of young adults. Indeed, the median age of a Twitter user is 31. In comparison, the median age of a MySpace user is 27, Facebook user is 26 and LinkedIn user is 40.7

It's hard having your age betrayed by the social networking application you use.

In my own (family) experience, children growing up now value the internet more than their cell phones (which are, in any case, just handy interfaces for networked communication). In fact, my children (all in their late teens or 20s) already live in a world far different from the one those of us born in the middle of the 20th century, grew up in, and I believe that they will see more change in the next five decades than we did in the last five—far more. Keyboards and monitors will disappear and will be replaced with voice recognition and heads-up displays of

various sorts, video walls, video scrolls, etc. I expect my children to be the last generation who know how to type, even if only with their thumbs. Already, with the introduction of the iPhone we're seeing a significant shift in the direction of mobile handheld data devices. Not that there weren't such devices before the iPhone, but Apple's smart-phone was a breakthrough in usability, and when they opened their platform to independent software developers, it became a breakthrough in business models as well. In fact, last night—nine months after the iPhone App Store opened, it passed the 1 billion mark for apps downloaded. Many of those apps are free, and most of the rest cost a couple of dollars. The average iPhone user has downloaded about 30 apps, special-purpose programs for entertainment, business, travel, reference, and other purposes. Since the iPhone has an accelerometer and (in the latest version) GPS built into it, these apps can interact with the world around the user, and with other users' phones, in some really interesting ways. You can turn your phone into a level, a wireless mouse, a wii-like game controller, or a re-orientable display. You can also share your location and locate your self for others: my current favorite app is the Ocarina, which uses the mike on the phone as a mouthpiece, by blowing into which and manipulating four “finger-holes” on the screen, you can play music—but you can also allow others around the planet to listen in and see where you're playing from, and you can eavesdrop on their playing as well, and bookmark players you like.

So, does anyone believe that the university leading the way, at this point? Can we have a show of hands? Perhaps in deep technical arcana, but not, I think, in discovering and disseminating new uses for the network. And are we academicians in any sense a presence on the same channels, in the same media, in the same world of ideas, practices, and cultural phenomena that our students inhabit? Some of us, yes—certainly, in this room—but most of us,

very little, perhaps not at all. Meanwhile, the train on which the rest of culture is riding is about to leave the station.

Fifteen years ago, the challenge before us was to imagine how new technology might provide a new platform for the practice of scholarship and teaching, but today our challenge is the reverse. It is no longer about opening the university and inviting the public in: it's about getting out where they already live, and meeting the public in the information commons, on the same terms that everyone else does.

In fact, it's almost too late for us. We will find that hard to believe, ensconced (as we all are) in solid-seeming residential universities, with long histories and the expectation of a long future—but older institutions on more solid foundations have been swept away or radically transformed in cultural upheavals of the past. In spite of the inertia of these institutions, which we all know so well, the forces of change outside the institution have much greater inertia, and all of the practical furniture of our daily academic lives could easily be gone, or changed beyond recognition, in a generation.

So, let's consider some of the modalities of vernacular computing, and think about how they are affecting the rest of the culture, and how they might affect higher education. WiFi is increasingly taken for granted, to the point where one finds it advertised at truck stops—which means that long-distance truckers are carrying laptops and doing networked computing in large enough numbers to make WiFi a drawing card for them. We take it for granted, now, in everyday life, that we can call one another at any time, and not just when we're sitting by the phone (and "sitting by the phone" is a concept that will be difficult to explain to our grandchildren); we take it for granted that we can pick up our laptops and take them into the next

room or the coffee shop across the street or wherever, without losing touch with the network. That mobility means we can be where we want to be, or need to be, without being out of touch with family, with work, or with friends. Today, we probably all know someone who telecommutes at least part of the time, and some of us teach regularly at a distance, and whereas we once “surf” the web (conjuring images of leisure and fun in the sun), we now increasingly “serf” the web (think servitude, instead of surf boards).

UNT's College of Information has a long history of online instruction, as well as a history of research engagement in learning technologies. These are topics that have interested me since I taught my first class in virtual reality (in a MOO) back in the early 1990s. More recently, I have taught a graduate seminar in digital humanities, in real time, online, to students in our online masters program (called LEEP). Many LEEP students are in the Chicago area—just a couple of hours away from campus, and some are even in Champaign or Urbana—though most are scattered across the United States and some are in the far east, in Africa, in Western Europe, and in South America. Classes meet once a semester for a day, face-to-face; the rest of the time we conduct real-time online classes once a week for a couple of hours. Half of our graduate students are enrolled in the online program, and it has the highest retention rate (95%), highest sense of belonging, and highest morale of any of our programs. Students find this delivery option compelling because they have jobs, families, and lives that they cannot or will not leave in order to undertake a couple of years of residential education. You know all this, of course, from your own experience here at UNT, where you began aggressively promoting online learning in the mid-90s, under Philip Turner, and where in some sense the Department of Learning Technology has been grappling with teaching with and about technology since near the

beginning of the last century. That makes both units, and the College that contains them, a great resource for the University of North Texas, and for the information field in general.

As we enter into the 21<sup>st</sup> century, lifespans are lengthening, people are continuing to work into what once would have been retirement years, and they routinely have more than one career in a lifetime—sometimes three, four, or five. In a world that's characterized by multiple sequential careers, individuals will need to retrain and re-educate themselves several times in their adult lives, and they'll need to do it while working, maintaining a family, etc. Will this kill off residential undergraduate education? No, but as that becomes more and more expensive and less and less representative of education as a whole, it will probably decrease in importance, except perhaps as a way of establishing new social networks or reproducing old ones in new generations. Will online education be solitary, by comparison to the residential experience? I expect, on the contrary, that it will be characterized increasingly by real-time collaborative work, and it will have a greater intensity than "real" classrooms. And while many people tend to think of information technology as replacing or actively militating against social interaction, in fact I think we can already see that in many ways the mobility that IT already offers us has important benefits on the social side, not least of which is the ability to choose your place of residence based on criteria other than the location of work or school.

One of the truisms about technology is that as it matures, it tends to disappear from view, simply becoming part of the fabric of everyday life. With information technology, this is borne out by what's now called "embedded computing." As the home page for the *Journal of Embedded Computing* tells us,

In today's world, embedded computers are everywhere: automobiles, airplanes, home

appliances, medical devices, cell phones, network processors, handhelds, digital audio/video, imaging, game consoles, graphics and other system-on-a-chip (SoCs). Embedded computers, even sophisticated ones, have been used in academic and commercial products and systems, for over twenty years.

So what difference will this make to us? In a strictly practical sense, to begin with, it will make the same difference in higher education that it does in general: it will offer us a tradeoff between privacy and convenience. As one wag put it, in the 1994 Elon/Pew survey of internet predictions,

In the world of the future, people will use low-cost Radio Shack equipment to spy on themselves to find out who they are.

- Eric Hughes, 1992  
<http://www.elon.edu/predictions/25briefbitingprediction.aspx>

In 2009, though, it's not cheap Radio Shack equipment, but embedded Radio Frequency Identification chips, now about the size of a flake of pepper, that allow surveillance and identification. In an online publication called "The Register" (motto, Biting the Hand that Feeds IT), Scott Granneman wrote

Right now, you can buy a hammer, a pair of jeans, or a razor blade with anonymity. With RFID tags, that may be a thing of the past. Some manufacturers are planning to tag just the packaging, but others will also tag their products. There is no law requiring a label indicating that an RFID chip is in a product. Once you buy your RFID-tagged jeans at The Gap with RFID-tagged money, walk out of the store wearing RFID-tagged shoes, and get into your car with its RFID-tagged tires, you could be tracked anywhere you travel. Bar codes are usually scanned at the store, but not after purchase. But RFID

transponders are, in many cases, forever part of the product, and designed to respond when they receive a signal. Imagine everything you own is ‘numbered, identified, catalogued, and tracked.’ Anonymity and privacy? Gone in a hailstorm of invisible communication, betrayed by your very property.”

Scott Granneman, “RFID Chips Are Here” (from June 27, 2003, *The Register*)  
[http://www.theregister.co.uk/2003/06/27/rfid\\_chips\\_are\\_here/](http://www.theregister.co.uk/2003/06/27/rfid_chips_are_here/)

For those in the humanities and the social sciences who worry about issues of identity, issues of privacy, issues of surveillance, there is much to be discussed and examined in the advent of RFID, and it is important that these humanists and social scientists should be involved in that discussion. For those who work on the organization of information—for example in library and information science, RFID represents an enormous onslaught of data—really, it is the administrative impulse of capital taken to its logical conclusion, with every consumer item (and every consumer) uniquely identified, tracked through interactions with other goods and services, and catalogued in some mad Borgesian database of everything everywhere.

Nonetheless, there are potentially some positive educational implications for RFID, embedded computing, and the rest of this brave new world: tracking unique objects through systems, either by checkpointing or by using RFID in combination with GPS, could be the basis for many interesting educational scenarios. An obvious one is tracking students as they explore museum exhibits (Hsi, S. Semper, R., Brunette, W., Rea, A., and Borriello, G. (under review) eXspot: A Wireless RFID Transceiver for Recording and Extending Museum Visits. *Ubicomp* 2004). “Mediated immersive” experiences have also been developed, in scenarios like this one, from a class actually taught at MIT:

Students role-play environmental scientists investigating a rash of health concerns on the MIT campus linked to the release of toxins in the water supply. Working in teams, players attempt to identify the contaminant, chart its path through the environment, and devise possible plans for remediation. As participants physically move about campus, their handheld devices respond to their location, allowing them to collect simulated field data from the water and soil, interview virtual characters, and perform desktop research using mini-webs of data. At the end of the exercise, teams compile their data using peer-to-peer communication, and synthesize their findings.

Described in “Planning for ‘Neomillennial’ Learning Styles: Implications for Investments in Technology and Faculty,” Chris Dede, Harvard Graduate School of Education, 2004. <http://www.gse.harvard.edu/~dedech/DedeNeoMillennial.pdf>  
See <http://education.mit.edu/ar/> for more information on this and other “augmented reality” learning games.

It’s not too difficult, I think, to translate this “environmental detectives” scenario into a literary or historical context: think of a guided exploration of London in connection with Defoe’s *Journal of the Plague Year*, perhaps delivering period newspapers, ballads, and broadsides, paintings and drawings, all keyed to the students’ physical location at any given moment. Or think of students exploring Civil War battlefields in Virginia or Maryland, reviewing accounts of the battles as well as the military records and perhaps even the diaries of those who took part in the battles.

And although at present we think the Web is somehow self-contained—something we use or visit, not something we inhabit—as Bill Mitchell has pointed out,

Networks at ... different levels will all have to link up somehow; the body net will be connected to the building net, the building net to the community net, and the community net to the global net. From gesture sensors worn on our bodies to the worldwide

infrastructure of communications satellites and long-distance fiber, the elements of the bitsphere will finally come together to form one densely interwoven system within which the knee bone is connected to the I-bahn.

– William Mitchell, 1994

From <http://www.elon.edu/predictions/20edgyincisivepredictions.aspx>

This sort of prediction of what's now called "ubiquitous computing" is far more plausible today than when it was originally made, fifteen years ago. It depends on technologies all of which are now in production, and though not all of those technologies are ubiquitous at present, their diffusion is only a matter of time. The transition from the kinds of mobility that we now take for granted (WiFi, cellphones) and the kind of network speeds that we are increasingly coming to expect (broadband), to the kind of ubiquitous and pervasive (and even invasive) computing that we've been discussing here is just a step, and at this point not even a very big one. The consequences of that step, though, will be profound, and I think particularly so for university education, which will have difficulty reconciling its place-bound, classroom-based, lecture-oriented instruction with the mobile, situated, and need-driven information behavior of its future students. If this seems a far-fetched thing to worry about, consider how long we've had cellphones, widespread only in the 1990s, and how rapidly they have become a fixture of everyone's everyday life. Then ask whether you would like to be in the business of selling corded phones on land-lines in 2009. Roughly speaking, that's the situation that traditional university education is now in.

In order to understand its situation a little better, we might compare education to other sectors of the culture, and look at how each of these sectors has dealt with the rising internet- and

computer-literacy of the average citizen in everyday life.

Commerce seems obviously to have responded most quickly and most enthusiastically: by 2004, the web was widely used for price-comparison and product research in advance of purchasing (by 78% of those with internet access, according to Pew), and 67% of those with internet access purchased online. The most successful applications and services of the web, for the general public, have been things like Ebay, the online flea-market, Amazon.com, the online department store, and self-service travel sites like Travelocity. In fact, commerce is increasingly globalized to the level of the individual consumer: services to the body are perhaps the exception and a long-term holdout: I still don't buy haircuts on the internet, or restaurant meals. But Google has a local business center which allows businesses to use Google maps to help potential customers find places nearby where they might go to **get** a haircut.

Government has also responded fairly quickly to the changing connectedness and literacies of citizens: here again, we see more self-service and more transparency, as well—at least for those who are connected. Government services like renewing a driver's license are increasingly available online, and no longer require a visit to a government office. The US Post Office itself now provides to online customers almost all of the services you can get by visiting the Post Office in person. In the related area of political campaigns, the assertion of agency and authorship by voters has made some remarkable inroads into party politics, for example in the most recent presidential elections, which offered perhaps the starkest contrast ever between the politics of networked community-organizing, and the politics of traditional media.

Healthcare is an interesting sector in comparison to education, more like it in some ways than commerce, where the consumer is in control of the transaction, or government, where

democratic institutions are tasked with disseminating their information to citizens as broadly and effectively as possible (though of course that doesn't always happen). In healthcare, as in education, the client is *not* in control of the transaction, for the most part—and perhaps not coincidentally, in these sectors the results of pervasive internet access are more mixed, so far. On the one hand, the web empowers patients with respect to research on their own conditions, so that patients now come to consultations having more recent and specific research in hand than do their physicians. Internet access also has begun to give patients more oversight of their own records, online. On the other hand, most doctors still do not make themselves available by email, self-service only extends to things like WebMD and over-the-counter remedies, and telemedicine is still mostly at the experimental stage, though I note that another Obama priority is promoting online medical records, in the control of the patient, and I note that Google now provides a free facility for managing your health records—complete with importing those records from your healthcare providers, sharing the records as you see fit, predicting drug interactions, tracking your medical history, and providing reference material related to your health issues and conditions.

Google Health will certainly become more visible and more widely used in the coming years—even though people doubt that it is secure, recent studies suggest that (as with internet banking) they are willing to take a calculated risk for the sake of convenience and control. Nonetheless, healthcare is responding more slowly than Government or Commerce, and Education is responding even more slowly than Healthcare, I would argue. We have been talking about things like online and self-guided education for decades now, and even though informal, task-specific information-seeking is now the norm in daily life, our educational

institutions seem impervious to these changes. As one of the respondents to the 1994 Pew predictions survey said,

We should have learning centers, neighborhood electronic cottages ... [but] it would be easier to get the Pope to become a Buddhist than to get the schools to change.

Ed Lyell, 1993

From <http://www.elon.edu/predictions/25briefbitingprediction.aspx>

Why is education is one of the more resistant sectors of the culture, when it comes to absorbing and playing out the implications of vernacular computing? Arguably, part of the reason is that education exists in order to reproduce culture (as Pierre Bourdieu famously argued). Perhaps also part of the reason is that education is underfunded, and it has a significant install-base of residential (and print) infrastructure. Beyond that, the humanities in particular are backward-looking, in that they are historical in nature, and they are conservative, in the sense that they seek to preserve and carry forward the cultural record.

So, should we regard this resistance as a bad thing? Certainly not in all respects: critical functions require some resistance, for example. But it is also important to engage with the new, if you are going to effectively produce, analyze, or even object to it. I know that some of my academic colleagues will argue that it is our responsibility to respond to values other than relevance or convenience or fashion, in order to preserve an understanding of the beauty that is not fashionable, a wisdom that is not received, and truths that have been forgotten. But it's a false syllogism to argue that we cannot do these things and also adapt to new circumstances, teach in new ways, or bring new technologies into focus in our research and our writing. In fact, I would argue quite the reverse.

In 2004-2006, I chaired a national commission of the American Council of Learned Societies, a body whose members are scholarly societies like the Modern Language Association, the American Historical Association, etc. This commission is focused on the technical, human, institutional, and policy infrastructure needed to support the use of information technology in research and teaching in the humanities and social sciences: the short term for all that is “cyberinfrastructure.” In the course of the Commission’s public meetings in Washington, DC, New York City, Chicago, Los Angeles, Berkeley, and Baltimore, Commission members heard testimony from scholars, librarians, museum directors, social scientists, representatives of government and private funding agencies, and many other kinds of people. One of the things that emerged from these discussions is that the cultural record is currently fragmented over more or less arbitrary institutional boundaries—for example, the relevant materials for understanding one artist will be held in a dozen different museums, twenty libraries, and ten archives. The digitization of the cultural record, though, provides the opportunity to reunite that record, connecting its disparate parts and making the resulting whole available to the interested individual, over the network.

Taking these ideas a step further, in our final meeting Bernie Frischer (a classicist and my successor as director of the Institute for Advanced Technology in the Humanities at the University of Virginia) offered us a true grand challenge problem, one that would take more computing power than now exists on the planet, and would require intensive cooperation among scholars across all the disciplines of the humanities and the social sciences. Like most grand challenges, this one can be simply stated: simulate all of human history, for the entire planet. We can certainly do pieces of this already, and we can see one kind of example in Bernie’s own

Cultural Virtual Reality Lab, which models historical buildings and sites from the classical era. One of the grandest examples to date is the Perseus Project, which presents digitized representations of classical-era texts and art works, and in the past few years has begun to present some of the renaissance texts that reprocess that classical heritage. Connect the textual and art-historical record of classical civilization in Perseus with the modeling of historical buildings and sites in the Cultural Virtual Reality Lab, and you start to see the possibilities for a unified cultural record.

Some of you will know ECAI, the Electronic Cultural Atlas Initiative, which began at Berkeley, and which “uses time and space to enhance understanding and preservation of human culture.” We heard from Michael Buckland, one of the distinguished faculty members involved in the project, during the ACLS Commission meeting in Berkeley. ECAI is a fascinating and very practical attempt “to make virtual collections of scholarly data from around the globe accessible through a common interface;” doing this, in turn, “requires a means for making data interoperable across formats, disciplines, institutions, and technical paradigms.” Therefore, “some areas where ECAI is currently defining research objectives and and pursuing research” include:

- International, distributed multi-lingual gazetteers
- GIS in the humanities
  - o The importance of the time element
  - o The need for representation of fuzzy boundaries and incomplete information
- Visualization
  - o Data-driven two and three dimensional representation of cultural information

- Multi-lingual data access and representation
- Data management of large collections of data in multiple formats
- Metadata for cross-collection access to data, not just discovery

<http://ecai.org/tech/researchgoals.html>

One of ECAI's affiliated projects is “Timemap,” which was developed at the University of Sydney, with ECAI support. Timemap’s

unique time-handling provides an engaging and intuitive method of delivering historical, community, government, research and business information. Combining mapping and the time dimension gives new ways of visualising urban growth, the spread of empires, heritage sites, environmental change, weather patterns, traffic flow, earthquakes, mobile network faults, and much more — ranging in time scale from millions of years to seconds.

The goal envisioned in ECAI is not a holodeck-style immersion in virtual reality, but rather something much closer to the “mediated immersive” experience of the MIT environmental science class. And this is the sort of thing that we can do right now in some places, and soon almost anywhere, with current technology—wireless networks, cellphone technology, GPS, laptops, handhelds, and so on. What’s lacking, in many cases, is the unified, digitized, accessible cultural record. And while there are enormous computational challenges to overcome in getting from this stage to Bernie’s 3D immersion in a true simulation of cultural history, there are enormous—and in some ways more interesting—intellectual challenges to be overcome first, in digitizing, unifying, and making accessible that cultural record. Consider the difficulties that will arise when literary scholars, historians, archaeologists, anthropologists, linguists, and art

historians all have to come to agreement on naming, dating, placing, and describing all the elements of cultural production that were created, used, or exhibited in a particular place—say, London—in a particular period—say the 17<sup>th</sup> century. Working out the unification of the cultural record is, I would argue, the grand intellectual challenge of the 21<sup>st</sup> century, and it will probably take a century to accomplish, but it will be accomplished, and the iSchools, their faculty, their research, and their students will be at the center of efforts like this—because no group is better equipped, intellectually and pragmatically, to be the designers and facilitators of this kind of cyberinfrastructure.

But these are just one set of examples, from the area in which I work. Across the iSchools, there are many other examples of faculty doing research that connects the university to the world outside, in a wide variety of ways. Here are just a few examples:

- At Berkeley, faculty are studying online dating to better understand and improve computer-mediated communication. They're also working on California E-Services that would provide better and more user-friendly service to new business registrants.
- At Florida State, faculty are studying the effects of online health interventions and websites on public health, patient—provider relationships, and society, and they are analyzing the quality of health information websites and its effects on health outcomes.
- At Singapore Management University, faculty are collaborating with colleagues at Carnegie Mellon University on enforcing Security in Mobile and Ad Hoc Networking.
- At the University of Maryland, the International Children's Digital Library (ICDL) is looking at how children access and use digital books to explore diverse cultures using a

library containing almost 3,000 digitized books from over 37 countries. And they have an iPhone app.

- One of our newer members, the Royal School of Library and Information Science, Denmark has faculty studying how information and service offerings are produced, delivered, disseminated, evaluated and presented in digital information spaces.
- At Penn State, faculty are studying technology for social inclusion is a research area concerned with the use of information technology to facilitate the construction of collective self-representation among people who have been historically excluded and disenfranchised.
- Faculty at Pitt and Carnegie Mellon are working on a project, entitled "III-COR: Collaborative Research: User-Centric, Adaptive and Collaborative Information Filtering," which aims to significantly improve adaptive filtering technologies by understanding how to learn from multiple users with broad applications in information retrieval.
- UNT: faculty work on legal information, natural language processing, digital storytelling, reading, medical informatics, e-learning, information retrieval and information-seeking, user-interface, copyright, and other matters relevant to the day-to-day use of computers.
- And at the university of Illinois, in the Community Informatics Initiative...  
go to the web site....

As I began by saying, we will have to go out to meet the public in the information commons they now, increasingly, inhabit, and where government, commerce, and other aspects of civic life are already being conducted. Education and scholarship must be there too. In some cases, this means delivering formal education at a distance, but in many other cases it means more informal

education that delivers the fruits of academic research to “lifelong” learners, who are pursuing an interest rather than a degree. We need to be doing this not only for altruistic reasons—for the benefit of the public—but for more selfish professional reasons as well: the cultural record is being digitized, with or without us. I believe that this massive effort cannot be completed without participation from the commercial sector as well as support from public funding and private philanthropy. Google Books may be a sore subject in many academic libraries, but it proves that commercial interests believe that there is sufficient public interest—and sufficient potential for profit—to merit digitizing whole research library collections (only about half of which are even in English, by the way) in a whirlwind operation that will cost many, many millions of dollars. But I also believe that domain experts in the many facets and the long history of that cultural record must be involved in the process, and I believe that we should embrace this project as the renaissance of the humanities and social sciences, as well as an enormous opportunity for the iSchools, and the work of a generation or more. The unified cultural record that will result is going to be the basis for research projects and teaching methods that we can’t yet begin to imagine, for cross-cultural understanding that we badly need.

Establishing this infrastructure for learning will be as important, in shaping the future of the planet, as the establishment of the university infrastructure has been in shaping the last millennium in Europe and North Africa (or the last 2700 years in India). With that in mind, I hope that all of you, having weathered structuralism and poststructuralism, will leave this lecture thinking of yourself as infrastructuralists—the designers and builders of the unified cultural record, a legacy for generations to come.

Thank you very much.